Does Fiscal Federalism Promote Regional Inequality?
An Empirical Analysis of the OECD, 1980-2005

JASON SORENS

Department of Political Science, University at Buffalo, SUNY

This paper explores the relationship between fiscal federalism, understood as institutionalized regional economic self-rule, and convergence in regional per capita incomes. The principal economic argument against fiscal federalism is that, unless paired with generous equalization grants, it will enhance regional inequalities by reducing inter-regional redistribution. Does the evidence support this claim? Multilevel spatial regressions on primary sub-national jurisdictions in 25 OECD countries show that lower-income regions tend to catch up to higher-income regions only when they enjoy substantial economic powers. Indeed, there is more convergence across member states of the EU than across regions *within* almost any of the EU members. Fiscal federalism may pose less serious tradeoffs than commonly assumed.

INTRODUCTION

Does decentralizing economic and fiscal policies to regional governments encourage inequalities to develop between citizens in different regions? The assumption that it does is commonplace. TSEBELIS (2002, p. 89) is one example among many:

> I can understand why federalism is likely increase inequalities: some transfer payments are restricted within states. Consequently, if the federation includes rich and poor states, transfers from the former to the latter are reduced compared to a unitary state.

Some public finance economists argue that these inequalities widen over time in fiscally federal systems, as rich regions are able to provide more public goods at lower cost per unit of income than poorer regions (BOADWAY, 1982; PRUD'HOMME, 1995; SHAH, 2006). BERAMENDI (2007, p. 786) characterizes this position as the 'dominant view,' and challenges it on the grounds that regional inequality determines institutions for redistribution, not vice versa. Some scholars have even argued that fiscal federalism of a particular kind could erode regional disparities in per capita income (WEINGAST, 1995; QIAN and WEINGAST, 1997).

Since differing theoretical assumptions yield contradictory empirical implications, the topic is ripe for empirical analysis. That is this paper's contribution. It differs from prior studies of the question by including formal political institutions in the key independent variable rather than just the distribution of tax revenues between center and regions, and by examining growth rates of the regions rather than aggregating regional per capita incomes to national indices of inequality.

The next section explores and clarifies the theoretical predictions from the theoretical literature on fiscal federalism. The third section lays out the empirical research design, multilevel GDP growth convergence regressions. The fourth section presents and discusses the results of analysis, the fifth section the possible effects of equalization programs, and section six concludes. Contrary to the 'dominant view,' the evidence supports the hypothesis that decentralization of economic policy, including taxation, *encourages* the convergence process, whether or not 'equalization' systems of redistributive, intergovernmental grants exist.

THEORY

Some public finance models hold that when equalization programs are not in place, decentralization of tax and economic policy encourages widening regional inequalities and reduces economic growth by encouraging the misallocation of particularly mobile resources. On the other hand, advocates of 'market-preserving federalism,' most notably Barry Weingast, argue that decentralization has precisely the opposite effect on both growth and in-

equality, and that equalization programs incentivize stagnation. This section lays out the logic behind these differing predictions and operationalizes them as testable hypotheses.

In a static sense, it is trivially true that decentralization of taxation policy without equalization will increase regional disparities in personal income (RODRIGUEZ, 2006). The reason is that all democracies redistribute from higher-income to lower-income citizens, presumably because the income of the mean citizen is always higher than the income of the median voter (MELTZER and RICHARD, 1981). Thus, regions with higher per capita income tend to see fiscal outflows, and regions with lower per capita income tend to see fiscal inflows (BOLTON and ROLAND, 1997). Reducing the fiscal impact of the central government and forcing regional governments to rely on revenues raised from their own citizens therefore reduces redistribution from high-income to low-income regions, increasing post-tax income in the former and decreasing it in the latter.

The real controversy over fiscal federalism and equalization is not this static, one-time effect of decentralization, but whether fiscal federalism, especially without equalization, reduces the economic growth rates of poorer regions and increases those of richer regions. If richer regions can attract more investment than poorer regions because of their larger ex ante tax bases, then fiscal federalism adversely affects the growth prospects of poorer regions by reducing the resources available for either central or regional governments to fund valuable projects in poorer regions. On the other hand, poorer regions might be poorer in part because of growth-suppressing policies, either central government policies that are effectively economically biased against particular regions or harmful regional government policies. If this is the case, then fiscal decentralization with tax autonomy should reduce the scope for growth-killing policies and cause poorer regions to catch up to richer ones. Finally, another possibility is that some regions are poorer simply because they are attractive places to live in ways that are not financially lucrative. Some Americans surely choose to live in Montana despite the low wages in order to participate in a certain lifestyle or to enjoy its natural beauty. If this is the case, then even full labor and capital mobility with ideal public goods provision will not end all observed regional income disparities.

Market-preserving federalism theory (WEINGAST, 1995; QIAN and WEINGAST, 1997) assumes that rents and rent-seeking are a significant drag on economic growth in modern societies, and that governments would like to maintain high levels of rents for themselves but face a tax base constraint. Mobility allows firms and taxpayers to escape high-rents jurisdictions, which also have high taxes or regulations. Governments therefore have an incentive to keep taxes and regulations at a more efficient level in order to attract a larger tax base. Centralization, for instance funding local governments mostly through grants rather than own-source taxes, weakens the competitive constraint on governments and allows rents and consequently allocative inefficiencies to rise. RODDEN (2003) has found evidence that decentralization of tax revenues decreases government spending, supporting the positive dynamics of the market-preserving federalism model, if not necessarily its normative thrust.

QIAN and WEINGAST (1997, p. 89) criticize Germany's and Canada's equalization programs for providing the wrong incentives to poorer provinces. They tout instead 'equalization through competition' in the United States, implying that fiscal federalism's beneficial effects on convergence will be stronger *without* equalization. Reducing fiscal transfers to low-income regions is problematic if these transfers enable growth-promoting projects, but is positively beneficial if the transfers harm growth (LESSMANN, 2009).

By contrast, many public finance economists maintain that richer regions with a larger tax base per capita can fund basic public goods at a lower tax rate than can poorer regions with a smaller tax base per capita. Therefore, richer regions should attract investment more easily than poorer regions, and regional gaps in per capita income should accordingly widen (PRUD'HOMME, 1995). These scholars often see jurisdictional competition for mobile factors of production as economically inefficient, since in an ideal market factors would flow to their most productive uses, and only with perfectly harmonized taxation can factor income perfectly reflect productivity (BOADWAY, 1982). These economists have therefore generally advocated generous, redistributive, intergovernmental grants to go along with decentralization of economic and taxation policies. By funding a nation-wide standard of provision, usually measured by per capita government spending, central

governments make sure that rich regions do not have a competitive advantage over poor ones in attracting businesses and taxpayers. The following quotation illustrates the logic well:

> Decentralized decision making results in differential net fiscal benefits...for citizens depending on the fiscal capacities of their place of residence... A nation that values horizontal equity (the equal treatment of all citizens nationwide) and fiscal efficiency needs to correct the fiscal inequity and inefficiency that naturally arise in a decentralized government. Grants from the central government to state or local governments can eliminate these differences in net fiscal benefits if the transfers depend on the fiscal capacity of each state relative to others and on the relative need for and cost of providing public services. The more decentralized the tax system is, the greater the need for equalizing transfers. The elimination of net fiscal benefits requires a comprehensive fiscal equalization program that equalizes fiscal capacity...to a national average standard. (SHAH, 2006, pp. 19-20)

These 'technical' public finance arguments, which downplay state predation, suggest that decentralizing economic policy could promote development, especially in low-income regions, by allowing local knowledge and circumstances to determine policy (HAYEK, 1939 [1948]; TIEBOUT, 1956), but that this relationship will hold only if equalization grants are in place.

From these arguments, we can derive three testable hypotheses, listed below. The first two represent the traditional public finance view, while the last represents the contrasting view of Weingast and associates.

Hypothesis 1. Fiscal federalism promotes regional per capita income convergence if and only if substantial equalization programs are in force.

Hypothesis 2. Without equalization, fiscal federalism reduces regional per capita income convergence.

Hypothesis 3. Fiscal federalism promotes regional per capita income convergence, especially without equalization programs.

The study of fiscal federalism and regional development is important in its own right because of recent decentralization efforts in Belgium, Spain, Italy, and elsewhere (STEGARESCU, 2005). The Organization for Economic Cooperation and Development (OECD) has recently released several studies on sub-national governance and development 1997; 1999; 2007, and scholars have begun to study the relationship between fiscal decentralization and regional development. LESSMANN (2009) finds that tax decentralization correlates at the country level with lower regional inequalities, apparently supporting the market-preserving federalism model. In a study of 26 developed and developing countries, RODRÍGUEZ-POSE and EZCURRA (2010) find that *expenditure* decentralization is associated with lower regional disparities in developed countries, but not in developing countries, possibly because expenditure decentralization is a reasonable proxy for tax decentralization in developed countries but in developing countries more often reflects soft budget constraints (RODDEN, 2002). GIL, PASCUAL and RAPÚN (2004) find similar results at the country level for revenue decentralization. This evidence is suggestive but not conclusive, since regional inequality could fall due to stochastic shocks even if fiscal decentralization reduces the rate at which poor regions converge to the per capita income levels of the rest of the country.[1] Another limitation of this research is that the independent variable, tax or revenue decentralization, is often higher in programmatically centralized countries such as Denmark and Sweden than fiscally federal countries such as the United States (SORENS, 2010). For tbese reasons, this paper focuses on regional growth rates rather than country-level measures of regional inequality – in the jargon of endogenous growth theory, on β convergence rather than σ convergence – and uses an institutional indicator of fiscal federalism rather than tax or expenditure decentralization.

EMPIRICAL DESIGN

In the neoclassical theories of economic growth dominant in the mid-20th century, growth was theorized to result from the addition of factors of production, especially capital investment. Increasing the capital-labor ratio makes labor more productive and increases per capita income (SOLOW, 1956). However, each additional unit of capital is less productive than the one before. Lower-income countries should grow faster than higher-income countries because the marginal productivity of capital is higher in the former than in the latter, and in the absence of catch-up growth, growth reaches a steady state determined by the rate of technological change. This is the hypothesis of 'absolute convergence.'

Evidence indicated that in fact richer countries have grown faster than poorer ones (BARRO, 1990). Revolutions in economic theory suggested a possible explanation: that growth results from improvements in total factor productivity attributable to advances in human capital and improvements in allocative efficiency due to better legal systems, protection of property rights, and lower transaction costs. 'Conditional convergence' is the hypothesis that different countries have *different* steady-state income levels due to their institutions and technologies, and that the larger the difference between actual and steady-state income, the faster the growth rate. Thus, if one were to control for all the technological and institutional factors that affect steady-state income, one should then find that poorer countries grow faster than richer ones (BARRO and SALA-I-MARTIN, 2004).

Since the 1970s, however, scholars have noticed an emerging bimodality in the global distribution of per capita incomes (BAUMOL, 1986; QUAH, 1996). 'Club convergence' is the empirical phenomenon whereby, when countries are grouped by initial criteria such as per capita income or geographic location, convergence happens faster within these groups than across them. Club convergence is theoretically controversial. The phenomenon might reflect the effects of omitted, possibly unmeasurable variables such as rule of law, corruption, and the cost of doing business. It could also reflect spatial diffusion of growth, in that countries may be affected by the growth rates of their neighbors (ERTUR *et al.*, 2006). For the purpose at hand, club convergence is a potential empirical nuisance rather

than a concept of theoretical interest. FISCHER and STIRBÖCK (2006) do not find club convergence in regional growth rates in the EU. Nevertheless, this paper's empirical format is robust to a particularly stringent form of club convergence, whereby each country has its own, distinctive steady state and its regions converge to this national steady state rather than to a global one. Spatial diffusion of growth across regions is also accounted for with spatial lags.

Institutional and technological differences across regions within the same country are generally smaller than those across countries. Therefore, it should be easier to find evidence for conditional convergence within countries than across them. In a regression framework, the convergence hypothesis predicts that initial per capita GDP should correlate negatively with subsequent GDP growth rate. Indeed, BARRO and SALA-I-MARTIN (1992) find convergence at approximately a 2 percent annual rate for US states over a long period. However, ARBIA *et al.* (2006) find no evidence of convergence in the European Union (EU) from 1980 to 2003. FISCHER and STIRBÖCK (2006) include central and eastern European countries (CEEC) and discover regional convergence in the EU from 1995 to 2000, again at annual rates of roughly 2 percent.

The canonical economic growth model is cross-sectional in form. The standard dependent variable is the annualized growth rate of per capita GDP (Y) of each country i over a certain number of years (τ), and the independent variables (X), including log per capita GDP, are measured at the beginning of that period (t):

$$\frac{\ln(\frac{Y_{it+\tau}}{Y_{it}})}{\tau} = \alpha + \beta X_{it} + \gamma \ln Y_{it} + \epsilon_{it}, i = 1, \ldots, n. \tag{1}$$

Conditional convergence in the above equation is found when γ is statistically significant and negative. This paper adapts this model for the regional level but includes a variable for fiscal federalism, both alone and interacted with Y_{it}, in order to determine whether the rate of regional convergence in per capita GDP varies with degree of fiscal federalism. The other difference is that the empirical models subtract national growth from regional growth and log national initial GDP from log regional initial GDP, so that they assume only that regions converge to a national per capita income, not to a global per capita income.

This model remains consistent if countries *do* converge to a global state. Moreover, this specification ends up eliminating all serial correlation in the error term. Thus, panel models with annual data can also be run. Another theoretical reason to prefer a multilevel to a 'flat,' pooled format is that most of the cross-national variance in regional economic performance is likely down to country-specific factors (OECD, 2007). By subtracting national from regional GDP/growth, the models can safely omit country-level control variables. The models are therefore explaining which regions have grown faster than the countries in which they are situated.

Initial log GDP per capita difference is measured in 2005 U.S. dollars, Purchasing Power Parity, and constructed as follows:

$$LGDPDiff_{rt} = \ln(Y_{rt}) - \ln(Y_{ct}), \tag{2}$$

where r subscripts the individual regions, and c subscripts the country in which each region is found.

The core cross-sectional regression models take the following form:

$$\frac{\ln(\frac{Y_{rt+\tau}}{Y_{rt}}) - \ln(\frac{Y_{ct+\tau}}{Y_{ct}})}{\tau} = \alpha + \beta_1 \overline{X}_{rt,t+\tau} + \beta_2 LGDPDiff_{rt} +$$

$$\beta_3 \overline{X}_{rt,t+\tau} LGDPDiff_{rt} + \beta_4 Z_r + \epsilon_r, r = 1, \ldots, n, c = 1, \ldots, N, \tag{3}$$

where X corresponds to the fiscal federalism variable (described below), and Z is a matrix of control variables.[2]

The two key independent variables are fiscal federalism, averaged over the period of analysis, and starting GDP difference as defined above. (Some readers may be concerned about endogeneity in fiscal federalism, but since the variable measures institutional characteristics [see below], it does not change very much or differ across regions in most countries, and political decisions to decentralize are not plausibly related to regional growth. However, models using initial fiscal federalism instead are also reported.) The statistical model assumes that regions converge toward their own country's steady-state per capita income at the same rate, given the same level of economic self-rule. For convergence to be found for any given region, $\left(\hat{\beta}_2 + \hat{\beta}_3 X\right)$ must be negative. $\hat{\beta}_2$ alone is the estimated effect

of initial per capita GDP ratio on regional minus country growth when fiscal federalism is zero. $\hat{\beta}_1$ alone is the effect of fiscal federalism on growth differential when initial GDP per capita difference is zero, relevant only in countries where regions differ in economic self-rule.

Regional data are available for different years for different countries, and data are available for the entire 1980-2005 period for only five countries. Reducing the temporal scope to 1995-2005 increases country coverage to 22. A middle course is to run the models over the 1991-2005 period, for which 14 countries have data. All these models are reported here, but a superior approach is to include all regions and years for which data are available, which can be done with unbalanced panel data. Since no serial autocorrelation is found (subtracting national growth from the dependent variable purges the business cycle from the series), a straightforward pooled model is possible:

$$\frac{Y_{rt} - Y_{rt-1}}{Y_{rt-1}} - \frac{Y_{ct} - Y_{ct-1}}{Y_{ct-1}} = \alpha + \beta_1 X_{rt-1} + \beta_2 LGDPDiff_{rt-1} +$$
$$\beta_3 X_{rt-1} LGDPDiff_{rt-1} + \beta_4 Z_{rt-1} + \epsilon_{rt}, r = 1, \ldots, n, c = 1, \ldots, N. \tag{4}$$

According to the market-preserving federalism theory (Hypothesis 3), economic self-rule should increase the growth performance of regions with lower initial GDP per capita (relative to the country as a whole) and decrease the growth performance of regions with higher initial GDP. When equalization programs are not in place, some traditional public finance arguments hold that economic self-rule will hurt low-income regions and benefit high-income regions (Hypothesis 2), but when equalization programs are in place these same arguments would predict that decentralization might aid convergence (Hypothesis 1). Equalization is not considered in these models, but will be dealt with in a later section. Hypothesis testing on $\left(\hat{\beta}_1 + \hat{\beta}_3 LGDPDiff_{rt}\right)$ at high and low values of $LGDPDiff_{rt}$ will determine whether rich or poor regions benefit more from fiscal federalism, and the estimate of β_3 tells us whether fiscal federalism assists ($\hat{\beta}_3 < 0$) or hinders ($\hat{\beta}_3 > 0$) the convergence process.

The units of analysis are those sub-central, regional jurisdictions with the greatest economic policy responsibility, defined below, within each OECD country (Table 1).[3] In a few

countries (Ireland, Portugal, and the UK), municipal governments exercise greater policy authority than higher-level regional authorities, but for reasons of data availability, the regional jurisdictions were used instead.[4] In geographical analysis, the 'modifiable areal unit problem' refers to the fact that the measurement of aggregate indicators depends on the definition of areal boundaries (OPENSHAW, 1983). In this case, the research question clearly points us toward a definition of regional boundaries, since we want to compare more fiscally autonomous regions to regions that are less fiscally autonomous but could conceivably obtain more autonomy in future reforms.

[Table 1 about here]

Fiscal federalism is operationalized as 'regional economic self-rule' (ESR), consisting of three elements: 1) programmatic autonomy in economic affairs, 2) funding of regional expenditure through autonomous taxation powers, and 3) political and institutional autonomy of the regional governments from central government veto or appointment authority. The first component captures the policy autonomy component of fiscal federalism, the second captures tax autonomy and the hardness of the subcentral budget constraint, and the third captures institutionalization. The fourth component of 'market-preserving federalism' as conceived by Weingast, the common market, is assumed to be virtually complete for all these cases, an assumption that would not necessarily hold in developing-country federations or for the EEC prior to 1986.

The recent economic literature has largely relied on alternative measures of decentralization drawn from fiscal data. The most popular data are those collected by STEGARESCU (2005), which measure sub-central autonomous tax revenues as a percentage of total government revenues. The assumption is that higher numbers reflect a higher degree of decentralization. However, this assumption is incorrect (SORENS, 2010). The Stegarescu data show that Denmark, Finland, and Sweden are among the most decentralized countries in the world, because county governments in those countries raise a great deal of revenue. What is ignored is the fact that sub-central governments in these countries have very little policy autonomy: the revenue they collect is for funding centrally mandated

programs. Indeed, in all these countries, the central government retains veto power over local decisions, and in Sweden, the central government appoints the county executive. Using fiscal data alone to measure economic decentralization is therefore highly misleading, because we should not expect regions in these countries to vary widely on public policies or to use fiscal policy to compete with each other for a mobile tax base, which is the mechanism by which some public-finance economists see decentralization as harming poor regions.

Therefore, the institutional measure of regional economic self-rule with the elements defined above, derived from SORENS (2010), is used. It is coded for all jurisdictions in a sample of mostly high-income countries that exist in a regional level with an average population of 150,000. This variable is drawn from data collected by HOOGHE *et al.* (2010) and has been validated through its negative partial correlation with government consumption in time-series cross-section regressions. It ranges from zero (no fiscal federalism) to 48 (maximum fiscal federalism). The construction of the variable is described in detail in the Data Appendix.

The top-scoring regions on ESR in 2005 are Navarre and the Basque Country in Spain, the Swiss cantons, the American states, and the Canadian provinces (and territories since 2002), which score 48. The regions of Belgium, the remaining autonomous communities of Spain, the regions of Italy, and Aaland in Finland all score 36 in 2005. Thirty-nine percent of all region-years in the dataset score zero. In some of the models the European Union will be considered as a single country, and the member states ('regions' of the EU) are scored the maximum of 48 on economic self-rule. Regions within the same country sometimes differ on economic self-rule, and therefore using regions as units of analysis in the statistical models does not simply duplicate data. Spain, the UK, Finland, Belgium, the US, Canada, Australia, Italy, and Portugal have all had asymmetric autonomy for some of the period under analysis. Figure 1 graphically displays the distribution of the variable in 1995, the start date for several of the regressions.

[Figure 1 about here]

Since the dependent variable is continuous, the estimation procedure is weighted least squares regression. Each observation is weighted by the region's percentage of its country's population (in the initial year for the cross-sectional regressions and in the previous year for the pooled regressions[5]). Weighting accomplishes three objectives. First, each country has equal weight in the dataset, rather than countries with more regions having greater weight. Second, weighting allows the mean of the dependent variable in the entire dataset to be approximately zero. Third, smaller regions are more sensitive to economic shocks and thus contribute to heteroskedasticity. For instance, small Greek regions have greater variance in economic growth than large German regions. Weighting smaller regions less than larger ones solves this problem (BAUM, 2006, p. 148). For other procedures dealing with nonspherical errors, see the Data Appendix.

Increasingly, economic growth researchers are recognizing that contemporaneous spatial dependence across economies violates Ordinary Least Squares' (OLS) assumption of an i.i.d. error term, in much the same way as temporal dependence violates this assumption in panel data (MAGRINI, 2004; FISCHER and STIRBÖCK, 2006). Lagrange multiplier tests on the cross-sectional models described above have been run, revealing spatial dependence in the data that could be modeled with either a spatial lag (spatial autoregression model or SAR) or a spatially dependent error term (spatial error model or SEM). Therefore, the 'spatial Durbin' model (SDM), which nests both the SAR and SEM, is justified as a first approach (LESAGE and PACE, 2009, pp. 46-50). Likelihood-ratio tests between the SDM and the more restricted models reveal whether one of the more restricted models may be used instead. With these data, these tests revealed that the SDM showed no statistically significant improvement over the SAR. However, SAR and SDM models with weighted observations have not been developed. Therefore, two types of spatial models are estimated here: the SAR with unweighted observations and the SEM with weighted observations.

The spatial weights matrix (W) is a queen contiguity matrix (ANSELIN, 1988), except that regions that are not adjacent to any other, such as exclaves and islands, are counted

as contiguous to the nearest region. The SAR therefore takes the following form:

$$y = \alpha + \beta_1 X + \beta_2 LGDPDiff + \beta_3 X \bullet LGDPDiff + \rho W y + \epsilon$$

$$\epsilon \sim N(0, \sigma^2), \qquad (5)$$

where $y = \frac{\ln(\frac{Y_{rt+\tau}}{Y_{rt}}) - \ln(\frac{Y_{ct+\tau}}{Y_{ct}})}{\tau}$.

The SEM takes the following form:

$$y = \alpha + \beta_1 X + \beta_2 LGDPDiff + \beta_3 X \bullet LGDPDiff + u$$

$$u = \lambda W u + \epsilon$$

$$\epsilon \sim N(0, \sigma^2). \qquad (6)$$

Interestingly, we do not necessarily see convergence in simple bivariate regressions of growth on log initial GDP per capita. Figure 2 shows a scatter plot of relative regional growth performance 1991-2005 against initial log GDP difference, 1991. The linear prediction line is flat, giving no indication of regional convergence within each country. If 1980 is used as the start date, convergence is evident, but only five countries report data. If 1995 is used as the start date, convergence is again absent. Finally, if pooled annual data are used, convergence is again not observed. Only multiple regression analysis can tell us whether economic self-rule tends to support convergence (or divergence), to which the next section turns.

[Figure 2 about here]

R E S U L T S   A N D   D I S C U S S I O N

Table 2 gives the pooled regression estimates. Model 1 is run on all available country-years. Model 2 includes the EU as a country: the EU12 from 1986-1995 and the EU15 from 1995-2005. For those years, the regions of EU member states are dropped, and instead EU member states are included as regions (East Germany is excluded for a consistent time series). Note that former Eastern Bloc countries are not counted as part of the EU during the period of analysis. Model 3 pools four-year periods: 1982-1986, 1986-1990, 1991-1995, 1995-1999, and 1999-2003.[6] For each observation in this model, the value of

the dependent variable is the growth rate over the period, while starting GDP is measured as of the first year of the period and regional ESR is the period average. The bottom three rows of the table give the results of one-tailed hypothesis tests on the marginal effects of regional ESR and log initial GDP difference at the specified values of the other variable: ESR is tested where log initial GDP difference is one standard deviation below and above zero, while the latter is tested at ESR's maximum.

[Table 2 about here]

The interaction term is negative, indicating that regional economic self-rule likely promotes convergence. The hypothesis tests show that we can be highly confident of fiscal federalism's benefits for poorer regions, while convergence is happening at the maximum value of self-rule in all models.

How economically significant are these results? Based on Model 1 estimates, Figure 3 shows how predicted regional growth differential changes as economic self-rule increases, at different values of initial GDP difference. At the maximum value of ESR and one standard deviation above/below zero on initial GDP difference, predicted regional growth is 0.6 percentage points higher/lower than national growth.

[Figure 3 about here]

Based on the same estimates, Figure 4 shows how initial GDP affects the marginal effect of economic self-rule on growth, with confidence intervals. When initial GDP per capita difference is just slightly below zero, we can be highly confident that ESR promotes growth. When initial GDP per capita difference is about a standard deviation above zero, we can be highly confident that ESR retards growth. Figure 5 presents the conditional marginal effects of GDP difference, depending on ESR. When ESR reaches 20, we can be highly confident that convergence happens. When ESR is zero, divergence is the more likely scenario, but it is not statistically significant.

[Figure 4 about here]

[Figure 5 about here]

Table 3 displays the results of three cross-sectional regressions. The first covers the years 1980 through 2005 and includes the five countries with regional GDP data for those years. The second model covers 1991 through 2005, allowing 14 countries to be included. The third covers 1995-2005, including 22 countries. Next, Table 4 reports the spatial lag and spatial error estimates on these three samples. Next, Table 5 reports the three original models but with initial fiscal federalism in place of period averages.

[Table 3 about here]

[Table 4 about here]

[Table 5 about here]

All the results are broadly consistent, although model 14 fails to reach overall statistical significance, and the interaction term is not particularly close to statistical significance in model 9. The spatial error models overall yield stronger results on the key interaction than the simple cross-sectional models. The spatial lag estimates diverge somewhat more, undoubtedly due to the lack of observation weighting. The strongest and clearest effects of self-rule on convergence can be found in the 1995-2005 data. Part of the reason for this may be better GDP measurement. The European regional GDP data from years prior to 1995 had to be converted to a constant-price PPP series (see Data Appendix). Model 6 suggests that regions with an initial GDP per capita difference one standard deviation below the mean and full economic self-rule can expect to grow 0.5 percentage points faster each year than their country as a whole. The range of that estimate for this hypothetical country over all the cross-sectional models is 0.2-1.0. These are reasonably close to the estimate of 0.6 from the pooled model displayed in 3.

Next, Table 6 reports 1986-1995 and 1995-2005 cross-sectional model results with the EU12/EU15 considered as countries. In the former time period, the former East Germany is omitted from German figures, but in the latter it is included, so that each model is run on a consistent time series. The central results remain consistent.

[Table 6 about here]

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Finally, I try using an alternative measure of regional ESR. This measure is the product of the institutional ESR score and the country-level tax decentralization score produced by Stegarescu (subnational own-source tax revenues divided by total tax revenues).[7] The tax decentralization scores add nuance to the regional ESR indicator, but because they are measured at the country level they also invite bias. In countries with asymmetric decentralization, this measure will be biased upward for the less autonomous regions and downward for the more autonomous regions. Table 7 reports the results from four representative models with this alternative indicator of fiscal federalism, cross-sectional models covering the years 1980-2005, 1991-2005, and 1995-2005, and a pooled model covering all available region-years. Note that the pooled and 1995-2005 models cover fewer observations than do the models using the standard ESR indicator, since the tax decentralization data are not available for the post-socialist Central and Eastern European Countries (CEEC) or for any years after 2001.

[Table 7 about here]

Two of the four models continue to show economic self-rule promoting the convergence process. Models 21 and 23, however, give essentially null results.

To sum up, 22 of 23 models show that fiscal federalism, understood as regional economic self-rule, actually promotes the convergence process, helping poor regions relative to rich ones, and in most cases we can reject the null hypothesis at reasonable values of initial GDP. The impact is substantively meaningful, as relatively poor regions (one standard deviation below the mean) can expect to outperform the national growth rate by a quarter to a full percentage point each year in a fully fiscally federal system. This finding supports Hypothesis 3 especially, the expectation of the market-preserving federalism and regional specialization literatures. In the next section, we discuss, based on the nature of the data and the previous literature on the subject, whether these results are driven by federal systems with strong interregional equalization.

According to RODDEN (2010), the vast majority of federal states undertake massive equalization programs to ensure the same per capita level of subnational spending across jurisdictions. The only federal systems in which Rodden finds that regional resources largely determine regional spending, indicating low equalization, are the United States, the European Union, and three developing countries, Argentina, Brazil, and India. These last three federations are notorious for soft budget constraints and central governments' political interference and should not be considered fiscally federal in the strict sense (PARIKH and WEINGAST, 1997). The European Union, meanwhile, has an equalization program, but it redistributes such a small amount of money that differences in per capita spending across member states are still largely determined by per capita income. In the United States, federal taxing and spending are redistributive across individuals and therefore states, but the federal government does not disproportionately provide grants to lower-income state governments (SHAH, 2006; RODDEN, 2010).

Most studies of equalization and convergence or disparity have focused on one or two countries. COULOMBE and DAY (1999) find that interregional disparities are more persistent in Canadian provinces than northern American states, implying that equalization in Canada is ineffective. In particular, the propensity to migrate to growing jurisdictions is lower in Canada. RODRIGUEZ (2006) examines the β-convergence process in Canada and finds that when transfers to individuals are included in personal income data, convergence in personal income is faster than when these data are excluded. However, this evidence does not speak to equalization grants' dynamic effects on regional policy-making, the core of the economic critique of equalization grants. The appropriate counterfactual can only be constructed if we undertake cross-national comparisons.

In the sole broadly cross-national study of this issue to date, KESSLER and LESSMANN (2010) find that there is a *positive* relationship between subnational governments' dependence on fiscal transfers and regional disparities in per capita income. This evidence seems to refute Hypothesis 1 in this paper, that equalization programs prevent regional divergence under fiscal federalism. Indeed, the authors interpret their evidence in this fashion.

However, it is not a definitive test, since the level of subnational dependence on transfers does not necessarily correlate with the extent of equalization. American states are comparatively dependent on federal grants, but the redistributive effect of these grants, from rich to poor states, is, at least according to Rodden's calculations, modest.

In future, it will be desirable to devise measures of the size of progressively redistributive transfers at the level of the subnational governments. However, a rough, preliminary look at specific cases reveals that the relationship between fiscal federalism and regional growth convergence found in this paper does not appear to be conditional on such equalization programs. For instance, the most decentralized system in the dataset, the European Union, also had the highest annual convergence rate between 1995 and 2005. The EU-15 group during this period converged at an annual rate of 8.0% (7.3% if Ireland is excluded). The EU-12 converged at a more usual 1.9% rate between 1986 and 1995, and it is possible that the anticipation and introduction of the euro had something to do with the spectacular convergence observed in the later period. Nor does there appear to be a significant difference in convergence between Canada and the U.S., two otherwise similar countries, the former with a robust equalization program and the latter with more transfers but with less redistributive impact. Between 1981 and 2005, both countries' regions converged at an annual rate of 1.6%.

Thus, both existing findings and a preliminary look at individual cases suggest that equalization programs are unnecessary for promoting regional convergence in fiscally federal systems, but the topic remains an important one for future research.

C O N C L U S I O N

The goal of this paper was to determine whether fiscal federalism bears a cost in terms of lower growth for lower-income regions, relative to higher-income regions. Political-economic theory suggests two possible answers. First, when regional governments must rely on autonomous revenues for their own expenditures, lower-income regions would have to charge higher tax rates to provide the same public services that higher-income regions provide. If those public services promote future growth, then lower-income regions

would be under a permanent disadvantage in a fiscally federal system without equalization grants. On the other hand, fiscal federalism allows mobile factors to move across jurisdictions to avoid high tax rates, encouraging regional convergence in tax rates and the squeezing of rents. If lower-income regions suffer from structural economic inefficiencies, then fiscal federalism could benefit them disproportionately by dissolving these inefficiencies. Even if low-income regions do not suffer especially from rent-seeking and other inefficiencies, they might be able to use tax and regulatory policy to attract capital under a fiscally federal system, a strategy unavailable to them if these policies are in the hands of the central government. Low-income regions are often geographically peripheral and thus suffer from inherent disadvantages that they can overcome only when given authority to set their own economic policies. Thus, fiscal federalism could actually benefit low-income regions more than high-income regions.

Since theory is ambiguous, empirical analysis is critical to resolving the debate. This paper uses OECD regions as observations in pooled and cross-sectional growth regressions to examine the conditional effect of regional economic self-rule on convergence in per capita income. Most results suggest strongly that economic self-rule substantially reduces the growth performance of high-income regions relative to that of low-income regions, and none of the models show any association between economic self-rule and divergence. Further, there is little evidence of regional convergence within countries unless the regions enjoy widespread autonomy in economic affairs. Overall, these results are therefore consistent with recent findings in the σ-convergence literature, which has found that in advanced democracies tax decentralization is associated with decreasing variance in regional per capita incomes within countries (Ezcurra and Pascual, 2008; Lessmann, 2009; Rodríguez-Pose and Ezcurra, 2010), while large transfer systems may actually increase regional disparities by discouraging interregional migration (Kessler and Lessmann, 2010).

These results might, on the whole, be considered a vindication for the predictions of regional specialization and market-preserving federalism theorists. On the other hand, no OECD country approximates a pure 'market-preserving federalism' model. Even the

highly fiscally decentralized EU intervenes extensively in agricultural markets and regulatory standards and has recently softened member states' budget constraints with bailouts of Greece, Ireland, and Portugal. All these results tell us for certain is that, within the range of alternatives exemplified by the OECD member states over the 1980-2005 period, those governments that allow regional governments more extensive autonomy over economic affairs, including taxing and spending powers, have seen their lower-income regions grow faster relative to the country as a whole. As economic policy decentralization and fiscal autonomy remain hot-button political issues in Scotland, Catalonia, France, Italy, and elsewhere, these results should at least allay our fears that devolving such powers from the central government to the regions will lead to a gradually widening gap between poor and rich regions.

D A T A   A P P E N D I X

Variables in the Regressions:

Variable: Log GDP per capita difference

Description: See text, based on GDP per capita in 2005 U.S. dollars, Purchasing Power Parity

Scale: Log points

Sources: Eurostat REGIO, US Bureau of Economic Analysis, CanStat, Australian Bureau of Statistics, OECD.Stat

Construction notes: non-PPP data were converted to PPP data using national conversion data from Penn World Table 6.3. All post-1995 data are PPP in the original (OECD) source. Current-price series were converted to constant price series using price level data from Penn World Table 6.3.

Variable: GDP growth difference

Description: (Annualized) regional growth rate minus (annualized) national growth rate

Scale: 0-100 (percentage)

Sources: see above

Variable: Regional economic self-rule (ESR)

Description: Extent of politically effective regional autonomy in economic policy and taxation. It is created by multiplying policy scope, fiscal autonomy, and representation variables from Hooghe *et al.* (2010), then dividing by 2 if institutional depth$\neq$3. The codings of those variables are as follows:

Policy scope (the range of policies for which a regional government is responsible):

　0: no authoritative competencies in any of these three areas: economic policy, cultural-educational policy, welfare state policy

　1: authoritative competencies in one of the three areas above

　2: authoritative competencies in at least two of the three areas above

　3: authoritative competencies in at least two areas above, and in at least two of the following: residual powers, police, authority over own institutional set-up, local government

Fiscal autonomy (the extent to which a regional government can independently tax its own population):

　0: the central government sets base and rate of all regional taxes

　1: the regional government sets the rate of minor taxes

　2: the regional government sets base and rate of minor taxes

　3: the regional government sets the rate of at least one major tax: personal income, corporate, value added, or sales tax

　4: the regional governments sets base and rate of at least one major tax

Representation (the extent to which a region enjoys an independent legislature and executive):

　0: no regional assembly, the regional executive is appointed by the central government

1: an indirectly elected regional assembly with a centrally appointed regional executive

2: a directly elected assembly with a centrally appointed executive, or an indirectly elected assembly with dual executives appointed by regional assembly and central government

3: indirectly elected assembly with a directly elected or assembly-appointed executive, or a directly elected assembly with dual executives appointed by assembly and central government

Institutional depth (the extent to which a regional government is autonomous rather than deconcentrated):

0: no functioning general-purpose administration at regional level

1: deconcentrated, general-purpose administration

2: non-deconcentrated, general-purpose administration subject to central government veto

3: non-deconcentrated, general-purpose administration not subject to central government veto

Scale: 0-48 (integers)

Sources: SORENS (2010). Accessed from http://www.acsu.buffalo.edu/~jsorens/ fiscfed-region.xls, August 30, 2010.

Variable: Economic self-rule (alt.)

Description: Regional ESR × Tax decentralization (subcentral autonomous tax revenue divided by total tax revenue)

Scale: continuous, bounded below at 0

Sources: STEGARESCU (2005)

Variable: % population

Description: Regional population divided by national population

Scale: 0-1 (decimal)

Sources: Eurostat REGIO, US Census Bureau, CanStat, Australian Bureau of Statistics,

Statistical Yearbook of Japan, OECD.Stat

Nonspherical errors

As discussed in the text, heteroskedasticity is modeled by weighting observations by regional proportion of national population, except in the spatial lag models. Standard errors in the pooled regressions with annual data (1 and 2) were corrected for contemporaneous cross-panel correlation. Standard errors in the pooled regression with grouped data (3) are robust, clustered on regions. Standard errors in all cross-sectional, least-squares regressions are robust, clustered on countries.

N O T E S

1. On the other hand, one advantage of σ convergence models over β convergence models is that the latter are sensitive to the possibility that relatively poor regions may overtake richer ones completely. This possibility should be less relevant in models with annual data than in cross-sectional models with growth measured over long time periods.

2. Growth rates are converted from decimals to percentages.

3. Some OECD countries, such as Mexico and South Korea, are excluded for lack of data.

4. In separate analyses, these cases were dropped to assess the robustness of the results. No appreciable differences were found.

5. Weighting by initial population percentage in the pooled regressions was also tried, yielding little difference in results.

6. The 1990-1 period is excluded so that Germany can be included.

7. In the cross-sectional models it is averaged over the relevant years up to 1999, rather than 2005, since the tax decentralization are not always available after 1999.

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Table 1. Countries and Jurisdictions under Analysis

Country	Jurisdictions	Number	Regressions
Belgium	Regions	3	1-4
Bulgaria	Oblasti (Provinces)	28	2
Germany	Länder	16	1,2
Greece	Nomoi (Prefectures), Attica	51	1-4
Spain	Autonomous Communities, Cities	19	1-4
France	Regions	22	1-4
Italy	Regions	21	1-4
Hungary	Megyék (Counties)	20	1,2,6
Netherlands	Provinces	11-12	1,2,4
Austria	Länder	9	1,2,4
Poland	Wojwodni (Voivodeships)	16	1,2,6
Romania	Judeţe (Counties)	42	2
Slovak Rep.	Kraje (Regions)	8	1,2,6
Sweden	Län (Counties)	21	1,2
Norway	Fylker (Counties)	19	1,2,6
United States	States, Federal District	51	All
Canada	Provinces, Yukon Territory	11	1,2,4-6
Australia	States, Territories	8	1,2,6
Japan	Prefectures	47	1,2,6
Denmark	Amter (Counties), capital city	15	1,2,4
Finland	Maakunta (Regions)	20	1,2
Ireland	Regions	8	1,2
United Kingdom	Regions	12	1,2
Portugal	Regions	7	1,2,4
Switzerland	Cantons	26	2-5
EU-12	Member states	12	5
EU-15	Member states	15	6

Table 2. Pooled Regression Estimates

Model:	(1)	(2)	(3)
Variable	Coef.(SE)[P]	Coef.(SE)[P]	Coef.(SE)[P]
Economic self-rule$_{t-1}$	0.0004(0.003)[.906]	0.0021(0.0021)[.317]	0.001(0.003)[.682]
Log GDP difference$_{t-1}$	0.4(1.0)[.669]	0.7(1.2)[.531]	0.43(0.50)[.391]
ESR • LGDPDiff	-0.065(0.028)[.018]	-0.049(0.027)[.065]	-0.079(0.026)[.002]
Constant	-0.04(0.1)[.730]	-0.13(0.09)[.142]	-0.08(0.07)[.246]
N (regions)	7526 (495)	4693 (428)	1385 (444)
Sample	region-years	EU as country	region-periods
Adjusted R^2	0.003	0.002	0.028
F	6.68[<.001]	4.23[.006]	3.61[.013]
$\Pr((\beta_1 - 0.24\beta_3)<0)$	.003	.014	.001
$\Pr((\beta_1 + 0.24\beta_3)>0)$	.037	.088	.007
$\Pr((\beta_2 + 48\beta_3)>0)$	<.001	<.001	<.001
WLS regression estimates. See Data Appendix for information on standard errors.			

Table 3. Core Cross-Sectional Regression Estimates

Model:	(4)	(5)	(6)
Variable	Coef.(SE)[P]	Coef.(SE)[P]	Coef.(SE)[P]
Economic self-rule	0.0012(0.0010)[.300]	0.0018(0.0014)[.188]	0.0037(0.0016)[.025]
Log initial GDP difference	0.44(0.33)[.256]	-0.1(0.5)[.899]	2.3(0.4)[<.001]
ESR ● LGDPDiff	-0.029(0.015)[.124]	-0.058(0.035)[.097]	-0.090(0.018)[<.001]
Constant	-0.04(0.03)[.175]	-0.09(0.03)[.008]	-0.17(0.04)[<.001]
N (years)	113 (1980-2005)	259 (1991-2005)	424 (1995-2005)
Adjusted R^2	0.039	0.222	0.174
F	3.64[.122]	25.6[<.001]	11.0[<.001]
$\Pr((\beta_1 - 0.24\beta_3)<0)$	.045	.051	<.001
$\Pr((\beta_1 + 0.24\beta_3)>0)$	.103	.077	<.001
$\Pr((\beta_2 + 48\beta_3)>0)$	.055	.067	.003
WLS regression estimates.			

Table 4. Spatial Regression Estimates

Model:	(7)	(8)	(9)
Variable	Coef.(SE)[P]	Coef.(SE)[P]	Coef.(SE)[P]
Economic self-rule	-0.002(0.002)[.383]	0.003(0.002)[.229]	0.011(0.003)[<.001]
Log initial GDP difference	0.74(0.30)[.014]	-0.92(0.30)[.002]	0.11(0.31)[0.710]
ESR • LGDPDiff	-0.051(0.009)[<.001]	-0.021(0.011)[.069]	-0.015(0.015)[.318]
ρ	0.38(0.09)[<.001]	0.33(0.06)[<.001]	0.37(0.05)[<.001]
Constant	-0.0001(0.07)[.999]	-0.13(0.06)[.047]	-0.40(0.07)[<.001]
N (years)	113 (1980-2005)	259 (1991-2005)	424 (1995-2005)
Log likelihood	-59.4	-244.2	-601.3
	(10)	(11)	(12)
Economic self-rule	0.0012(0.0022)[.583]	0.0015(0.0028)[.600]	0.0036(0.0026)[.176]
Log initial GDP difference	0.52(0.23)[.026]	0.08(0.27)[.767]	2.3(0.2)[<.001]
ESR • LGDPDiff	-0.031(0.011)[.005]	-0.051(0.012)[<.001]	-0.088(0.013)[<.001]
Constant	-0.02(0.06)[.740]	-0.07(0.07)[.315]	-0.16(0.06)[.003]
λ	0.20[.042]	0.28[<.001]	0.04[.461]
N (years)	113 (1980-2005)	259 (1991-2005)	424 (1995-2005)
Log likelihood	-60.4	-291.4	-649.5
Models 7-9 unweighted SAR estimates, models 10-12 weighted SEM estimates.			

Table 5. Estimates with Initial ESR

Model:	(13)	(14)	(15)
Variable	Coef.(SE)[P]	Coef.(SE)[P]	Coef.(SE)[P]
Economic self-rule	0.0011(0.0011)[.410]	0.0018(0.0015)[.254]	0.0035(0.0016)[.041]
Log initial GDP difference	0.1(0.2)[.650]	-0.01(0.4)[.976]	1.9(0.5)[.001]
ESR • LGDPDiff	-0.023(0.009)[.054]	-0.082(0.047)[.102]	-0.077(0.019)[.001]
Constant	-0.03(0.02)[.202]	-0.08(0.03)[.013]	-0.16(0.04)[<.001]
N (years)	113 (1980-2005)	259 (1991-2005)	424 (1995-2005)
Adjusted R^2	0.024	0.297	0.141
F	56.75[.001]	1.11[.379]	6.52[.003]
$\Pr((\beta_1 - 0.24\beta_3)<0)$	.020	.049	<.001
$\Pr((\beta_1 + 0.24\beta_3)>0)$	.098	.056	<.001
$\Pr((\beta_2 + 48\beta_3)>0)$	.018	.050	.008
WLS regression estimates.			

Table 6. Cross-Sectional Estimates, EU as Country

Model:	(16)	(17)	(18)	(19)
Variable	Coef.(SE)[P]	Coef.(SE)[P]	Coef.(SE)[P]	Coef.(SE)[P]
Economic self-rule	-0.003(0.001)[<.001]	-0.003(0.003)[.352]	0.0037(0.0018)[.043]	0.0027(0.0034)[.430]
Log initial GDP difference	0.73(0.44)[.100]	0.70(1.03)[.496]	2.9(0.6)[<.001]	2.7(0.3)[<.001]
ESR $\bullet$ LGDPDiff	-0.046(0.017)[.008]	-0.045(0.024)[.059]	-0.11(0.03)[.001]	-0.099(0.019)[<.001]
Constant	0.12(0.01)[<.001]	0.12(0.15)[.411]	-0.22(0.07)[.002]	-0.22(0.09)[.020]
N	93 (1986-1995)	93 (1986-1995)	218 (1995-2005)	218 (1995-2005)
Adjusted R^2	0.096	N/A	0.287	N/A
F	4.27[.007]	N/A	30.2[<.002]	N/A
$\Pr((\beta_1 - 0.24\beta_3)<0)$	0.100		<0.001	
$\Pr((\beta_1 + 0.24\beta_3)>0)$	0.014		<0.001	
$\Pr((\beta_2 + 48\beta_3)>0)$	0.026		0.004	
Models 16 & 18 WLS regression estimates, models 17 & 19 weighted SEM estimates.				

Table 7. Representative Models with Alternative ESR Measure

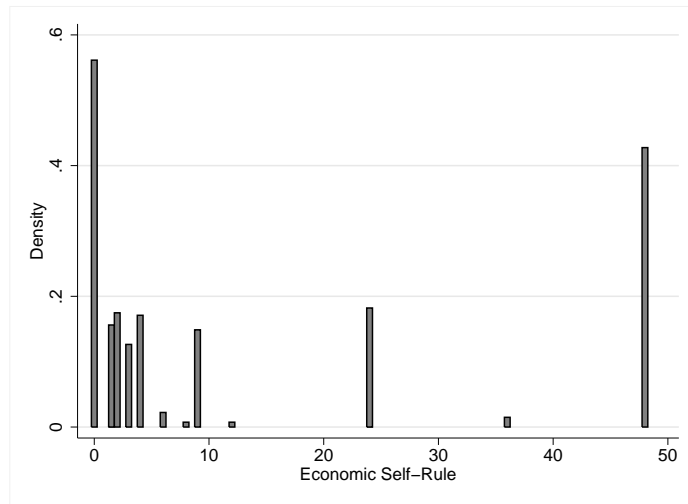| Model:	(20)	(21)	(22)	(23)
Variable	Coef.(SE)[P]	Coef.(SE)[P]	Coef.(SE)[P]	Coef.(SE)[P]
Economic self-rule (alt.)	0.001(0.001)[.568]	0.001(0.003)[.792]	0.001(0.003)[.794]	0.005(0.007)[.434]
Log initial GDP difference	0.17(0.23)[.498]	-1.2(1.1)[.292]	0.54(0.43)[.228]	-1.3(1.0)[0.202]
ESR(a) $\bullet$ LGDPDiff	-0.079(0.021)[.019]	0.022(0.057)[.708]	-0.070(0.031)[.037]	-0.004(0.054)[.943]
Constant	-0.02(0.02)[.302]	-0.70(0.35)[.068]	-0.086(0.024)[.002]	0.02(0.12)[.835]
N (years)	113 (1980-2005)	259 (1991-2005)	338 (1995-2005)	5194 (1980-2001)
Structure	cross-sectional	cross-sectional	cross-sectional	pooled
Adjusted R^2	0.072	0.148	0.019	0.006
F	23.1[.006]	1.42[.283]	2.58[.090]	11.6[.009]
$\Pr((\beta_1 - 0.24\beta_3)<0)$	0.015	0.626	0.027	0.689
$\Pr((\beta_1 + 0.24\beta_3)>0)$	0.006	0.658	0.023	0.365
$\Pr((\beta_2 + 24\beta_3)>0)$	0.002	0.102	0.007	0.028
WLS regression estimates.				

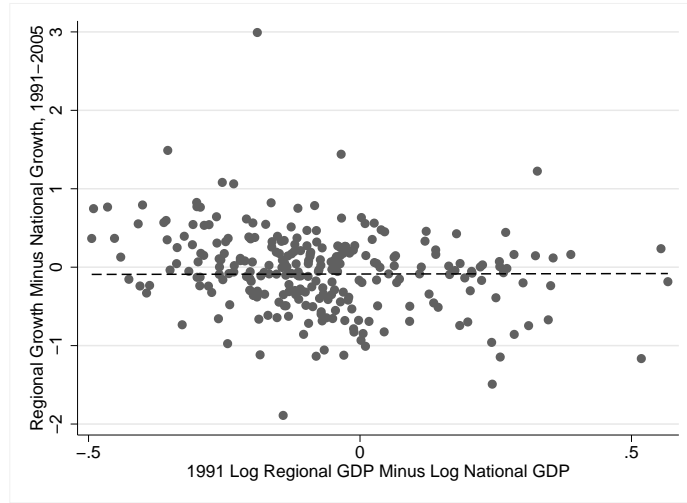*Fig. 1. Distribution of Economic Self-Rule in Sample, 1995*

Fig. 2. Initial Regional Income and Subsequent Growth Rates, 1991-2005
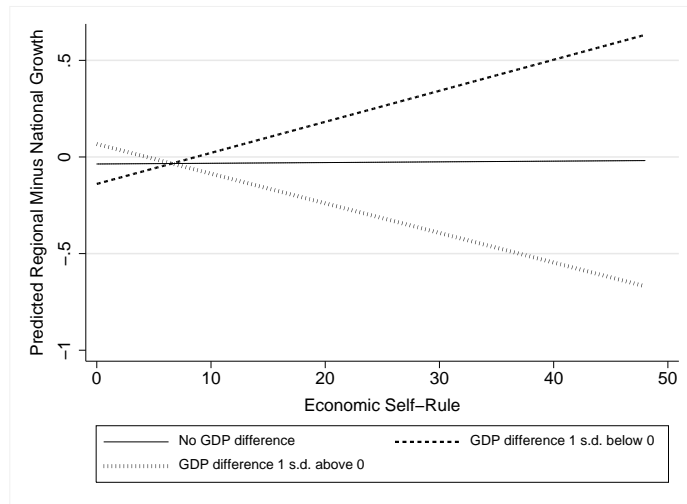
Fig. 3. Fiscal Federalism and Predicted Regional Growth
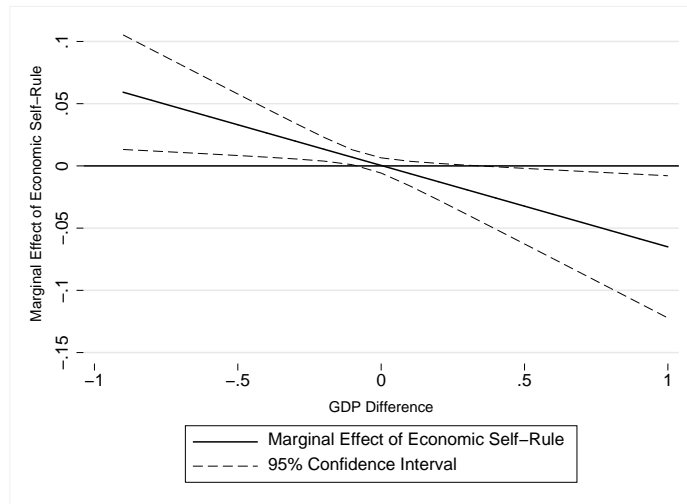
Fig. 4. Marginal Effects of Fiscal Federalism Conditional on Initial GDP
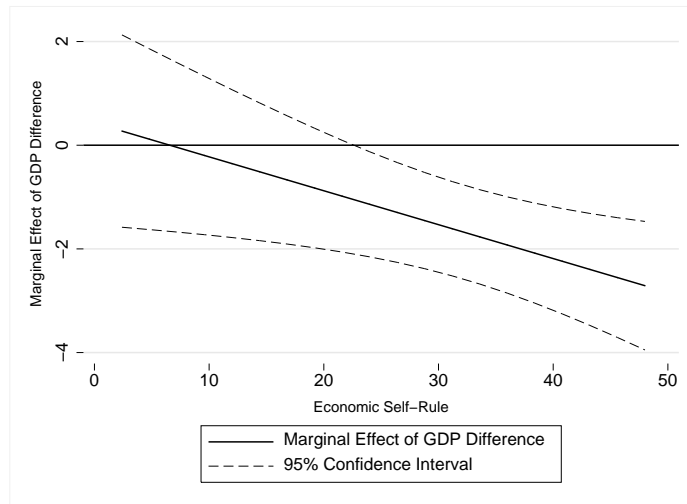
Fig. 5. Marginal Effects of Initial GDP Conditional on Fiscal Federalism